

resembles *Oreodon*, but in this genus the internal convolution is continuous with the supraorbital.*

EXPLANATION OF PLATE.

Brain of *Procamelus occidentalis* from a cast, two-thirds the natural size.

Fig. 1. View of the left side.

Fig. 2. View of the superior surface.

Fig. 3. View of the inferior surface.

On the Vertebrata of the Bone Bed in Eastern Illinois.

By E. D. COPE.

Read before the American Philosophical Society, May 20, 1877.

It is already well known that a few years ago, Dr. J. C. Winslow discovered in the Eastern part of the State of Illinois, a bone bed containing the fragmentary remains of reptiles and fishes. From some of this material placed in my hands, I identified four species of Vertebrata, two Rhynchocephalian reptiles, one a Dipnoan and one Selachian fish†. These were named, *Cricotus heteroclitus*, *Clepsydrops collettii*, *Ceratodus vinslovi*, and *Diplodus* sp. indet. It was stated in connection with the descriptions of these, that they indicate Triassic or Permian age for the bed in which they were found, since on the one hand *Reptilia* have not been found in the coal measures, nor on the other hand has the genus *Diplodus* been found above the Carboniferous series of rocks.

Doctor Winslow, in response to my inquiries, has sent for my examination another series of these fossils, which contains several species not previously known from the formation. Subsequently William Gurley discovered another exposure of the bone bed, and obtained a number of useful specimens, including some of species not previously known, which he also kindly placed at my disposal. To both these gentlemen I desire to express my sense of the obligation under which they have laid me. Descriptions of some of the species are now given; a complete account of the fauna is reserved for an illustrated memoir now in preparation.

STRIGILINA LINGUEFORMIS Cope, gen. et sp. nov. Petalodontidarum.

Char. Gen. The tooth is a flat osseous plate whose outline is pyriform, the wider end recurved in one direction as the transverse cutting edge; the other extremity narrowed and recurved in the opposite direction as the root. The side from which the cutting edge arises is crossed by numerous plicæ from the base of the root to near the base of the cutting edge; the opposite side is smooth.

The genus appears to resemble most nearly the *Climaxodus* of McCoy.

* Leidy, Extinct Fauna, Dak. and Nebraska, pl. xiv, fig. 11.

† Proceedings Academy Philadelphia, 1876, p. 404.

especially such species as the one figured by T. P. Barkas in the Atlas of his Manual of Coal Measure Paleontology Pl. I figs. 35-7 (Manual p. 20). From the latter it differs in the transverse instead of continuous relation of the edge and root to the main body of the tooth; the root does not appear to be differentiated at all in *Climaxodus*, while it is distinctly marked in *Strigilina*.

Char. Specif. The plicate surface terminates behind in a median angle, at the base of the root. There are eight plicæ which all cross the plane, excepting the sixth, which is interrupted in the middle by the strong angulation of the seventh, which touches the fifth. The lateral extremities of the right are in contact with the base of the recurved cutting portion. The latter is convex transversely, leaving a smooth surface between it and the eighth plica. The smooth side of the tooth is shining, and there is a shallow fold which passes round its side and crosses just at the base of the recurved cutting lamina. The edge of the lamina is unfortunately broken.

M	
Total length of plane.....	.008
Width at base of cutting lamina.....	.006
Width at base of root.....	.004
Thickness of plane portion.....	.0015

This species was found by William Gurley.

SELACHII.

DIPLODUS ? COMPRESSUS Newberry.

A few teeth of *Diplodus* found, are none of them perfectly preserved. One with a lateral and median denticles nearly complete, agrees pretty well with the species cited.

DIPNOI.

CERATODUS VINSLOVII Cope Proceed. Acad. Philada. 1876, p. 410.

CERATODUS PAUCICRISTATUS Cope, sp. nov.

The single tooth representing this species is narrow in the transverse direction, but stout in vertical diameter. But four ridges are present, all of which have a single direction, but the shorter ones are the less oblique to the long axis of the tooth. They all extend into the inner border, but become low as they approach it. Distally they are quite prominent, but do not project very far beyond the emarginate border between them. The inner border is plane and vertical, and without ledge; the inferior surface is concave in the transverse direction. The surface of the tooth is minutely and elegantly corrugated.

Length from base of second rib.....	.0170
Depth at base of second rib.....	.0045

From the collection of Dr. J. C. Winslow.

CTENODUS FOSSATUS Cope, sp. nov.

Represented by a nearly perfect tooth of a general narrow and vertically thickened form. There are five crests, the largest three extended in one

direction, and the other two in the other. Between the last of the latter and the inner border is a rudiment of another in the form a rugosity. None of the crests touch each other at their bases. At their extremities they curve rather abruptly downward, and do not project beyond the inferior plane, from which each one is separated by a deep fossa, whose mouth is a notch in its base. The crests are coarsely dentate, there being three or four teeth on each, and the grooves between them are marked by coarse transverse undulating grooves. The inner border is a deep vertical plane; the inferior face is narrow and concave in transverse section.

Total length.....	.022
Greatest width.....	.007
Depth at middle.....	.006

This is the first species of this carboniferous genus found at this locality. It differs from the *C. serratus* Newberry in its narrow form, small number of ridges, and the very slight prolongation of their extremities.

CTENODUS GURLEYANUS Cope, sp. nov.

This species is indicated by a portion of a tooth, which leaves the number of the ridges a matter of uncertainty. On this account its description might have been postponed, but that the distinctness of its characters, render it clear that it cannot be placed with any of the other species. The crown, as in *Ceratodus paucicristatus*, is narrow and rather thick; but three crests are present, all radiating in the same general direction, the longer close to the inner border. There was not more than one additional crest, or one and a rudiment, and these have probably the same direction as those which are preserved. The crests are sharp, elevated, and coarsely dentate; they are not decurved at the extremity, but cease abruptly with a projecting denticle, beneath which the basis is excavated by a shallow fossa. The inferior face is slightly concave, the internal wall vertical.

Greatest width.....	.008
Depth at inner border.....	.005

This *Ctenodus* is dedicated to William Gurley, to whose efforts science is indebted for this and several other interesting paleontological studies.

CROSSOPTERYGIA.

PEPLORHINA ARCTATA sp. nov.

Based on an unsymmetrical bone, bearing teeth, to be referred to the position of pharyngeal, pterygoid, palatine, or half of the vomerine elements. From the resemblance of the teeth to those on the palate of *Peplorhina anthracina*, I refer it provisionally to the corresponding position in the mouth of a second species of that genus. This course is open to modification should subsequent investigation require it.

The bone is plate-like and diamond-shaped, with the longer angles both recurved. The convex surface is thickly studded with teeth, which are not in contact with each other. Their size increases from one side of the

bone to the other, and still more, from one extremity to the other. The crowns are swollen at the nearly sessile base, and contract rapidly to a conical and unsymmetrical apex. Those of the smaller teeth are more conical, those of the larger more bulbiform. One side of the latter is slightly concave below the apex. The surface is shiny and distinctly grooved. Fractured crowns do not display any central cavity. There are sixty-five teeth on the plate.

Length of plate.....	.013
Width on short border.....	.007
Transverse width.....	.007
Depth.....	.002

OTHER TEETH.

Teeth of four other species have been found by Doctor Winslow, to which I allude only briefly, as their characters are not sufficient to enable me to distinguish them from those of known genera and species.

Species one. This is represented by a fragment of mandibular ramus, which supports six teeth, all of which have a greater or less part of their apices broken away. They stand in close juxtaposition, and are of equal sizes. The basal half or more of the crown displays the character of deep inflections or grooves. These teeth belong to some sauroid fish, or to a batrachian.

Species two. This is also represented by a portion of mandibular ramus which supports four teeth. The anterior of these is larger, and is separated from the others by an edentulous space. Their crowns are rather elongate and are compressed, having cutting edges fore and aft. Both edges contract to the apex, but the anterior the most so. There are a few shallow grooves at the base, but they appear to be superficial only. These teeth might belong to either a reptile or a batrachian, and it is useless to attempt to distinguish them by a name from the many genera of both classes that resemble them.

Species three. Two stout, slightly flattened, conic teeth without cutting edges, represent this species. They are anchylosed to a very thin plate of bone, a part of which adheres to each. The base is oblique, expanding more in one direction than another. The greater part of the crown is marked by closely placed parallel grooves, which are much more numerous than in the species No. 1. They are larger than these or No. 2, measuring .004 in diameter at the base. They may belong to any one of a number of known genera of Batrachia, or Sauroid fishes.

Species No. 4. These are more numerous than the others, occurring in Mr. Gurley's collection as well as in Dr. Winslow's first collection. There is nothing to prevent their reference to the *Lacertilia*, and I have thought that there is some probability of there being referable to the *Clepsydropus collettii*. They are not rooted, but are anchylosed in a shallow concavity of the jaw bone, which is only distinguished from that for the adjacent tooth by the corresponding scolloping of the lower margin

of the jaw. The opposite margin is a little more elevated and is more closely anchylosed to the base of the tooth. The crown is conic, subround in section, and curved backward. There are no cutting edges, and the base is a little flattened in front and in behind. On each of the faces thus formed, there is an open, shallow groove, sometime obsolete. There are no other grooves nor sculpture on the teeth.

Each specimen of this tooth is single, and anchylosed to the same (corresponding) part of the jaw. The tooth is at one extremity of the alveolar groove; above the opposite end is the basis of a bone attached at right angles (? prefrontal or malar). One of the specimens displays an extensive pulp cavity.

Length of crown.....	.010
Diameter at base.....	.004

ACTINOPTERI.

In the transactions of this Society, published in 1871, and more fully in the Proceedings of the American Association for the Advancement of Science, at the meeting of 1871 (published early in 1872), I showed that the supposed order of Ganoids as defined by Müller, is not a homogeneous or natural association of types. I pointed out that the recent genera must be distributed between two divisions of fishes of high rank, viz.: the *Crossopterygia*, and the *Actinopteri*. The last-named division was believed to include the fishes previously known as *Chondrostei* and *Teleostei*. Some of the so-called Ganoids of Müller and Agassiz were referred to different subdivisions of the *Actinopteri*. In a paper recently published in the Proceedings* of this Society, a better expression of natural affinities was thought to be obtained, by regarding the *Crossopterygia*, the *Chondrostei*, and the *Actinopteri*, as forming a single sub-class of the class Pisces, under the name of *Hyopomata*, the other sub-classes being the *Dipnoi*, the *Selachia*, and the *Holocephali*.

I had already referred *Phaneropleuron*† to the *Dipnoi*, when Dr. Günther's and Prof. Huxley's researches into the structure of *Ceratodus forsterii* led them to place this genus also in the same sub-class. Günther also refers the fossil genera *Dipterus*, *Chirodus* and *Conchodus* to the *Dipnoi*, and with these must go *Utenodus* and its immediate allies. The *Polypteride* and *Catlacanthida*, which were arranged by Huxley, with the preceding forms in his sub-order *Crossopterygia*,‡ are clearly *Hyopomata*, having well developed hyomandibular and maxillary bones, as well as characters of the pectoral fins equally wanting to the *Dipnoi*. It is thus evident that the division *Crossopterygia*, as left by Huxley, cannot be maintained, but that it must rest entirely on the definitions given by me in the papers above quoted, where the two families mentioned were the only ones referred to it. It is possible that a strict adhesion to the law

* May, 1877.

† Transactions American Philosophical Society, XIV, 1871, p. 450.

‡ Memoirs of the Geological Survey, Great Britain, Decade X.

of priority will require that the name *Ganoidei* should be retained for this division.

The tribe *Actinopteri* as left in my latest paper above quoted (May, 1877), has slightly different boundaries from those originally prescribed for it, since the *Chondrostei* are now excluded from it. As then and now understood, it is nearly identical with the *Teleostei* of Müller, a name which I should adopt for it, were it not that some of his *Ganoidei* and numerous extinct forms with unossified vertebral column belong to it. For such fishes the name of Müller is too glaringly inapplicable to be employed.

After excluding the extinct genera of *Hyopomata* which are clearly *Crossopterygia* and *Chondrostei*, there remains a numerous assemblage, whose relationships to existing types of fishes have never yet been ascertained. I refer especially to the families of the *Lepidoides*, *Sauroides* and *Pycnodontes*, of the Poissons Fossiles of Agassiz, and other forms subsequently described; among others, the *Dorypterus* of Germar. The only bond which retained these forms in connection with the fossil Crossopterygian fishes, the rhombic and enameled scales, may be safely disregarded in view of the important characters of the skeleton which declare their affinities to be diverse; the more as some of the latter (*Celacanthidae*) have rounded scales, and *Leptolepis* and other genera referred by Agassiz to the *Sauroides*, have cycloid scales. The heterocercal character of the tail of some of them, is of but little greater weight. I have already shown that fishes presenting this character (*Lepidosteus*, *Amia*) do not differ in other respects from other *Actinopteri*, while the still lower isocercal condition is often seen in the latter. Further, the extinct genera do not agree among themselves in this respect, some bring heterocercal, and some isocercal.

The question remains as to the proper location of the families just named, in the tribe *Actinopteri*. It has been impossible to discover all of the characters necessary to the fullest elucidation of this question, but the greater number of them have been satisfactorily ascertained. The following results are therefore approximations to the truth which I believe that future researches into the osteology will confirm. At the least they are much nearer to an expression of nature than any yet attained.

As regards the general affinities represented by the terms *Physostomi* and *Physoclysti*, there is no doubt that the *Lepidoides* and *Sauroides* exhibit the former. This is seen in the uninterrupted conjunction of the parietal bones (where it has been possible to observe the parts), and in the abdominal position of the ventral fins, and extent of the maxillary bone; as well as in the less important features of the absence of all ctenoid characters of scales and preoperculum, lack of spinous rays, etc. The *Pycnodontidae* present in general similar characters, and add nothing which should separate them widely from the Lepidoid genera of Agassiz, especially the family of the *Dapediidae*. Like these, however, they approach nearer to the *Physoclysti* in the anterior continuation of the interneural spines as far as the skull. This character is found also in some *Physostomous* fishes, *i. e.* the greater number of *Characinidae*, the *Elopidae*, *Umbridae* and some

Nematognathi. The *Dorypteridæ* present a number of peculiar features, approaching still more closely the *Physoclysti* in their thoracic ventral fins.

We may now consider the relations of the *Lepidoides* and *Sauroides* to the known physostomous orders.

The scapular arch being suspended to the cranium renders comparison with some recent orders with a free scapular arch, unnecessary. The simplicity of the anterior vertebrae leaves out of account the *Nematognathi* and *Plectospondyli*. The only orders with which we can compare them are those represented by their old companions in the Poissons Fossiles, the *Ginglymodi*, the *Halecomorphi* and the *Isospondyli*.

Although the *Sauroides* included the genus *Lepidosteus* in Agassiz's system, I cannot find that any of the fishes of the two families under consideration possess the peculiar vertebrae of that genus, which in part characterizes the order *Ginglymodi*. Neither have any of them the segmented maxillary bone. The real alternative is between the last two of the above named orders. Now the principal skeletal character which distinguishes these two, is found in the pectoral fin. In the *Halecomorphi* there are numerous basilar radii attached to a cartilaginous mesopterygium, in the *Isospondyli* there are but three or four such bones sessile on the scapular arch. After examining a number of specimens of species of both the Agassizian families named, I have been unable to discover any basilar bones whatever, and have suspected that they were, in the complete skeleton, of cartilaginous character. Professor Agassiz figures this region in his restoration of the "Lepidoid" genus *Platysomus*, and of the "Sauroid" genera *Macrosemius* and *Caturus*. In these, he represents the small number of basilar bones characteristic of the *Isospondyli*, and placed in the close relation to the scapular arch, which is seen in the same order. A consultation of the numerous figures given by Agassiz, Thiolliere, and others, has failed to discover a single instance exhibiting the peculiar basilar pectoral bones of *Amia*. This could scarcely be so uniformly the case did such bones exist, so that with Prof. Agassiz restorations coinciding, I can only for the present refer these fishes to the *Isospondyli*.

Their other special characters are so numerous, that they must be taken account of in deciding on their ordinal relations. If we, for the present, distinguish the two families as did Agassiz, we include in the *Lepidoides* the genera with teeth *en brosse* or in a single row, and sub-equal and obtuse; and in the *Sauroides* the genera with teeth of unequal sizes, some being large and raptorial, the others minute. Of the *Lepidoid* genera, Agassiz states that the vertebrae are osseous in *Lepidotus*, and says the skeleton of *Amblypterus* is osseous, without particularizing the vertebrae. The posterior vertebrae of *Paleoniscus* he states to be ossified, while in *Platysomus*, *Tetragonolepis* and *Dapedius*, the centra are not certainly osseous. In all of these genera the neural and hæmal arches are distinctly articulated with the centra. *Platysomus*, *Dapedius* and *Tetragonolepis*, present the important character of a series of basilar interneural and inter-hæmal bones, the interneurals commencing in *Platysomus* at the head.

This character separates these species widely from the other genera of the "*Lepidoides*."

As regards the "*Sauroides*," the vertebral centra are always represented as ossified, and the neural and hæmal arches articulated, with the possible exception of *Thrissops** where the arches are represented as continuous; the same point is not certainly determined in *Eugnathus*. None of the genera which I have seen, have the basilar interneural and interhæmal spines found in the *Dapediide*, above mentioned, nor are they figured or described by authors.

In these characters of the two groups, there is nothing allying the genera to the *Halecomorphi* rather than to the *Isospondyli*. The absence of the basilar interhæmals from all excepting the *Dapediide* is additional evidence of Isospondylous affinities. The ganoid scales of most of the genera, do not separate them from the typical forms of this order more widely than the *Arapema*, nor the vertebrated caudal fin more widely than the existing *Notopterus*. The number of vertebrae included in the axis of the caudal fin in the extinct genera is shown by Agassiz to be very variable. In *Megalurus*, this region resembles that of *Amia*; in *Leptolepis* and *Caturus*, the vertebrae are not more numerous than in the *Saurodontide*, while in *Thrissops* the fin is homocercal, in the Agassizian sense.

As already remarked, the *Pycnodontide* present some points of resemblance to the *Dapediide*. All the points necessary to a complete elucidation of their structure have not yet been observed, so that my conclusions are necessarily imperfect. A point of resemblance to the *Plectognathi* is seen in the cartilaginous space between the interneural and interhæmal spines and their respective fins; a space occupied in the *Dapediide* and *Dorypteride*, by the basilar interneurals and interhæmals. This character is however not universal in the *Pycnodontide*. Prof. Agassiz speaks (*Poissons Fossiles*) of a maxillary bone, which bears a few teeth, in this family. This character will distinguish it at once from the *Plectognathi* and all other physoclystous orders. The abdominal position of the ventral fins and unmodified anterior vertebrae, indicate that these fishes may for the present be placed with the preceding, in the *Isospondyli*. There they are well distinguished by the peculiar inverted chevron-like bones which protect the dorsal and lateral regions in front of the dorsal fin. Prof. Agassiz describes the vertebrae of *Pycnodus* as osseous; M. Thiollie figures some species as without osseous centra, a condition I have observed in some specimens.

The characters of the *Dorypteride* are, according to the very full description of Messrs. Hancock and Howse,† more strongly peculiar. Although these fishes may be referred to the *Physoclysti*, on account of the thoracic position of their ventral fins, they present features which will not permit a reference to any known order. It has been shown that they

*Description des Poiss. Foss. prov. d. l. Gisem. Jurass. d. le Bugey; premiere livr. Thiollie et Gervais.

† Quarterly Journ. Geolog. Society, London, 1870, p. 623.

possess the basilar interneural bones, which as I have pointed out,* only exist in the *Physoclysti* in small development in the *Batrachidæ*; and occur in various degrees of development in some *Physostomi*, being especially elongate in the anal fin of *Amia*. It is even possible that another element enters into the series connecting the neural spines with the dorsal fin-rays. The pectoral fin possesses fourteen or fifteen basilar radial bones; a character which like the last, is not found in the *Plectognathi*; these fishes having but three or four such elements. These two points indicate a lower position than that of the latter order, and a relation to it similar to that which *Amia* bears to the *Isospondyli*. It goes to show that even among some of the earlier fishes, physoclostous characters were foreshadowed. I therefore establish a new order for its reception to take its place at the base of the line of Physoclysti.

As a résumé of the preceding inquiry, the following table of the families treated of, with their definitions, is now given :

Order ISOSPONDYLI.

Physostomous fishes with distinct parietal bones; unmodified anterior vertebrae; and three or four basilar bones of the pectoral fin. Symplectic and præcoracoid bones present so far as known.

Fam. SAUROSIDÆ (*Sauroides* Agass. partim.)

Teeth of different sizes, the large raptorial ones mingled with small ones; vertebral column osseous; no basilar interneurals or interhæmals.

1. Caudal fin with many vertebrae; scales rhomboid;—*Pygopterus*, *Eugnathus*.
2. Caudal fin with few vertebrae; scales rhomboid;—*Pachycormus*,† *Sauropsis*, *Macrosemius*, *Belonostomus*, *Aspidorhynchus*.
3. Caudal fin with numerous vertebrae; scales rounded;—*Megalurus*, *Callopterus*,‡ *Attukeopsis*.‡
4. Caudal fin with few vertebrae (in some instances apparently none); scales rounded;—*Caturus*, *Leptolepis*, *Anedopogon*,§ *Thrissops*.

Fam. LEPIDOTIDÆ, (*Lepidoides* Agass. partim.)

Teeth simple, often obtuse, in one or many rows, without elongate ones intermixed; no basilar interneurals or interhæmals; vertebrae with the centra incompletely ossified;|| (scales rhomboid; caudal fin vertebrated.)

Amblypterus, *Paleoniscus*, *Eurynotus*, *Seminotus*, *Lepidotus*, *Pholidophorus*, *Microps*, *Notagodus*, *Ophiopsis*, *Cosmolepis*, *Pleuropholis*.

Fam. DAPEDIIDÆ mihi.

Teeth uniform, obtuse; vertebrae with incompletely ossified centra;|| the interneural spines commencing at the head; a complete series of basilar interneural and interhæmal spines;¶ *Platysomus*, *Dapedius*, *Tetragonolepis*.

* Transac. Amer. Philos. Soc. 1871, XIV, p. 451.

† Vide *P. heterurus* and *P. macropterus* Ag.

‡ Thiollère et Gervais Poissons Foss. de Bugéy.

§ Cope, Proceedings American Philosophical Society, 1871, p. 53.

|| These statements are derived from Agassiz, Poissons Fossiles.

¶ Agass. Polss. Fossiles, II, Pl. D, fig. 2.

Fam. PYCNODONTIDÆ.

Teeth obtuse molar, covering the vomer and palatine bones ; no basilar interneural and interhæmal bones ; chevron-shaped bones protecting the dorsal region, their branches extending on the sides ; abdomen protected by similar bones, which form plates on the median line ; interneurals continued far forwards.—*Microdon*, *Pycnodus*, *Gyrodus*, *Mesodon*.

Order DOCOPTERI mihi.

Scapular arch suspended to the cranium ; pectoral fin with numerous, (not more than fifteen known) basal radii ; ventral fins thoracic. Dorsal and anal fins with basilar interneurals.

Fam. DORYPTERIDÆ.

Vertebral column osseous ; caudal fin not or very shortly vertebrated. Interneural spines corresponding with the basilar on the abdominal, but not on the caudal parts of the vertebral column. Ribs complex, united with abdominal dermal bones which form a series of median plates.

None of the Isospondylous families above described possess the dental characters of the *Sauroidontidæ*, i. e. the long fangs set in deep alveoli.

RHYNCHOCEPHALIA.

CLEPSYDROPS COLLETTII Cope, Proceedings Academy, Philadelphia, 1876, p. 407.

This species proves to be the most abundant land vertebrate of the formation. It is represented in all the collections, sometimes by portions of individuals of double the size of the types. I referred this genus to the *Rhynchocephalia* originally, although it possesses a few batrachian characters. The occipital condyles preserved in the present collection are simple and median, thus confirming the reference, were confirmation needed. A supposed sacral vertebra is free at both extremities, and presents on each side, just behind the articular extremity, a very large facet, extending from a rudimental diapophysis to the plane of the inferior surface of the centrum. The specific reference of this vertebra is not certain.

CLEPSYDROPS VINSLOVII Cope, sp. nov.

This species is represented by a third cervical vertebra ; and probably by other centra, but in this one the characters distinguishing it from *C. collettii* are especially visible.

The inferior median line is a keel, some distance above it, the sides of the centrum are full, rising in a longitudinal angle. There is no constriction or fossa below the diapophysis as in *C. collettii*. The latter is anterior in position, is vertically compressed, and is curved forward for a short distance below. The posterior articular face is regularly funnel-shaped from the margin ; the anterior face has a broad recurved lip. This passes round the inferior margin, which is not projected forwards as in *C. collettii*. The

zygapophyses are well developed, and stand close together. The neural spine is compressed, and the basal portion points somewhat forwards.

	M.
Length of centrum.....	.011
Diameter of posterior articular face { vertical.....	.009
transverse.....	.009
Vertical diameter of diapophysis.....	.006
Expanse of posterior zygapophysis.....	.009
Anteroposterior diameter of base of neural spine.....	.005
Transverse diameter of neural arch.....	.006

CLEPSYDROPS PEDUNCULATUS, sp. nov.

Established on two vertebræ obtained by Mr. Gurley, of a lizard of larger proportions than any of those belonging to the other species of the genus. One of these is a third cervical and the other is apparently a dorsal, both differ from corresponding vertebræ of *C. collettii* and of *C. lateralis* in having elongate diapophyses for the attachment of the ribs. These are present in the other species, but are either very short, or sessile. The third cervical has a broad reverted anterior lip-like margin of the anterior articular face, which resembles the corresponding part in *C. lateralis* in not being produced below. The median line is keeled, and there is a shallow longitudinal groove on the upper part of the sides. The posterior articular face is regularly funnel-shaped. The diapophyses are very stout, and are directed a little downwards and strongly backwards. The articular faces are single, look downwards and outwards, and are wide above, and narrow below. The base of the neural canal is deeply incised, as in the other species.

Diameter of centrum, { anteroposterior.....	.015
{ transverse.....	.0125
{ vertical.....	.0120
Length of diapophysis above.....	.009
Diameter of diapophysis { vertical.....	.008
{ anteroposterior.....	.005

The dorsal vertebræ exhibits a longer and more slender diapophysis whose base is vertically expanded, and with a shallow fossa before and behind. The superior half of the diapophysis has a much greater anteroposterior extent than the inferior. There is no recurved rim of the articular extremities, but the surface does not pass regularly into the foramen chordæ dorsalis, but by an abrupt descent at its mouth. The sides of the centrum are concave, and the inferior portion forms a prominent rounded rib.

Diameter of centrum { anteroposterior.....	.016
{ transverse.....	.015
{ vertical.....	.016
Length of diapophysis.....	.009
Width of neural canal.....	.0065

CRICOTUS HETEROCLITUS Cope, Proceed. Acad. Phila. 1876, p. 405.

GENERAL OBSERVATIONS.

After an examination of the first fossils from this fauna which came under my observation, I left the question undecided as to whether its characters pointed to the Triassic or to Permian age. The *Reptilia* and a *Ceratodus* pointed to the former; the *Diplodus* pointed even to the coal measures. The additional evidence adduced in this paper, adds weight to both sides of the question. Of the fishes added, *Ctenodus* is a genus of the coal measures, and while *Strigilina* is new, its affinities are to the Petalodont genera of that formation. On the other hand the reptilian character of *Clepsydrops* is established, and the number of its species increased. Now the coal measures have nowhere disclosed reptilian remains, so far as we have determinations of a reliable character; *Batrachia* were the only type of air breathing vertebrata known to that epoch. The present fauna must then be placed above the coal measures, and the horizon will correspond more nearly with the Permian than with any other embraced in the system.

From its most characteristic fossil, the bed might be called the *Clepsydrops* shale. Its position, according to Dr. J. C. Winslow, is near the top of the Coal Measures, and it is marked No. 15, in Prof. F. H. Bradley's section of the Coal Measures of Vermillion Co., in the Report of the Geological Survey of Illinois by A. H. Worthen, Vol. IV, p. 245. It is about one hundred and eleven feet, averaging different localities, from the summit of the series, and 2099½ feet from the base. Two insignificant beds of coal occur above it, and the following genera of invertebrate fossils: *Productus*, *Spirifer*, *Athyris*, *Terebratula*, *Hemipronites*, *Retzia*, *Zeacrinus*, *Cyathaxonia*, *Discina*, *Lingula*, *Cardiomorpha*, *Orthoceras* and *Nautilus*. Several of these genera are found in the Zechstein, while others belong to the Coal Measures and below them.

On some new and little known Reptiles and Fishes from the Austroriparian Region.

By E. D. COPE.

(Read before the American Philosophical Society, May 20, 1877.)

A number of interesting points in the distribution of our reptiles and fishes come to light from time to time, which serve to define with more precision the districts into which the Nearctic Realm is naturally divided.* The result of several of these, is to extend over the entire Austroriparian Region the range of several species heretofore supposed to be confined to portions of that district only. A collection formed at Kinston in Eastern North Carolina, in the North-eastern portion of the region in ques-

* See Bulletin No. 1 of the National Museum; Check List of North American Batrachia and Reptilia.